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RE-EVALUATION OF
CHEMICAL POTENTIAL
OF
IMPERIAL IRRIGATION DISTRICT WELL NO. 1
O'NEILL GEOTHERMAL, INC.

Rogers Engineering Co., Inc.
16 Beale Street
San Francisco 5, California

APRIL 1963

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RE-EVALUATION OF CHEMICAL POTENTIAL OF I.I.D. WELL NO. 1

1. INTRODUCTION:

The chemical potential of the brine from I.I.D. Well No. 1 was evaluated and reported in Rogers Engineering Co., Inc. March 1962 Flow Test Report. This evaluation considered only the recovery of sodium chloride, as the prime salable product and alternately as the raw material for conversion to salable chlorine and caustic. Both cases showed low net revenue relative to the estimated capital investment required. The subsequent three month well flow test indicates continued production of a consistent type brine can be expected from this well. Based on the flow and composition data established during this test period, chemical production potential has been examined. The separation and sale of high quality potassium chloride appears attractive. Attached are sketches of each of the two production schemes considered with estimates of capital and operating costs and revenue.

2. RECOMMENDATIONS:

Potassium chloride is the major product returning large sales revenue. It is important therefore that a development program be undertaken to define the actual component separation and determine the most suitable route to obtain the intermediate sodium-potassium chloride feed for the final preparation of high quality potassium chloride. The Proving Plant, as shown in block diagram attached, would provide the information required to prepare a detailed proposal for well exploitation. This program would require a budget of approximately $75,000, including installation of $20,000 of new equipment and piping at the well head, and necessary facilities for brine disposal. The effluent from the proving plant should average less than 10 percent of the full flow test rates. Completion of this program will provide the information required to prepare refined estimates of production and cost.

3. DISCUSSION:

Well brine is composed largely of sodium chloride, lesser amounts of calcium and potassium chlorides and minor amounts of magnesium and other heavy metal chlorides.

Salt separation by water evaporation and crystalization has been estimated from known solubility data. Selective recovery of salable sodium chloride, a mixture of sodium and potassium chlorides and a residual high calcium chloride content bittern appears possible. The mixture of sodium chloride and potassium chloride can be further processed using the proven froth flotation process (syluite) to produce salable potassium chloride.

Solubility curves applicable to this brine have been estimated, using published data of the various salt pairs present. These curves have been used, in the absence of actual laboratory or operational data, in combination with the analysis of well head sample S-44 tabulated in Rogers' August 1962 Flow Test Report, to prepare preliminary heat and material balances. The values developed have been used to evaluate full scale chemical production via two schemes: Scheme A - Solar Evaporation and Power Production and Scheme B - Multi-Stage Evaporation, as shown in block diagrams attached. Attractive payment on invested capital is indicated. A combination of the two schemes may be required for optimum recovery of salable products.

While solar evaporation will yield a suitable separation of components, increased selectivity can be obtained by operation at higher temperatures. Sodium chloride has a low solubility change with temperature rise, while all other components increase in solubility markedly. Operation at high temperature increases the quality of the sodium-potassium chloride mixture relative to potassium, thereby improving the froth floatation processing step.

4. BASIS FOR ESTIMATES:

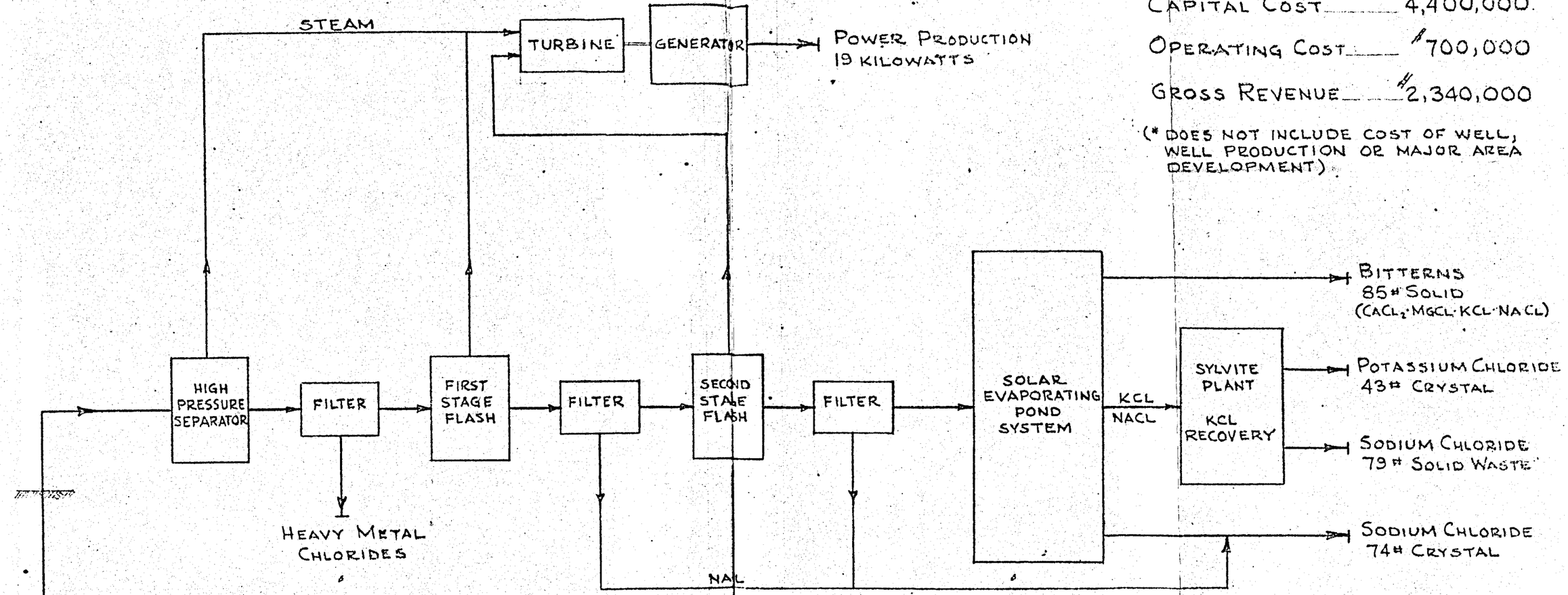
Solubility data for the major components along with the curves estimated to be applicable to this brine and the preliminary material balance calculations along with capital and operating cost estimates are available in Rogers Engineering Co., Inc.'s subject file.

Preparation of the capital cost estimates included breakdown of the flow scheme into definitive process equipment groups or unit operations. Installed cost was obtained by detailed take-off or by using major equipment ratios where appropriate. Overall construction contingency used was approximately twenty percent for both the multi-stage evaporation and the solar evaporation schemes.

The operating cost estimates were assembled by synthesis of operating job assignments, staff supervision and maintenance requirements, and the various operating materials and utilities.

Sales revenues are based on conservate values in known market areas adjusted to reflect at plant values.

Chemical prices were obtained from the Oil Paint and Drug Reporter and industry sources. The gross electric power generation was credited to sales and the plant power requirement was included as an operating cost.



*ESTIMATING DATA:

(BASIS: 425,000 #/HR. FLOW; 8000 HRS./YR.)

CAPITAL COST ____ #4,400,000.

OPERATING COST ____ #700,000

GROSS REVENUE ____ #2,340,000

(* DOES NOT INCLUDE COST OF WELL, WELL PRODUCTION OR MAJOR AREA DEVELOPMENT).

REVENUE BREAKDOWN: (AT PLANT)

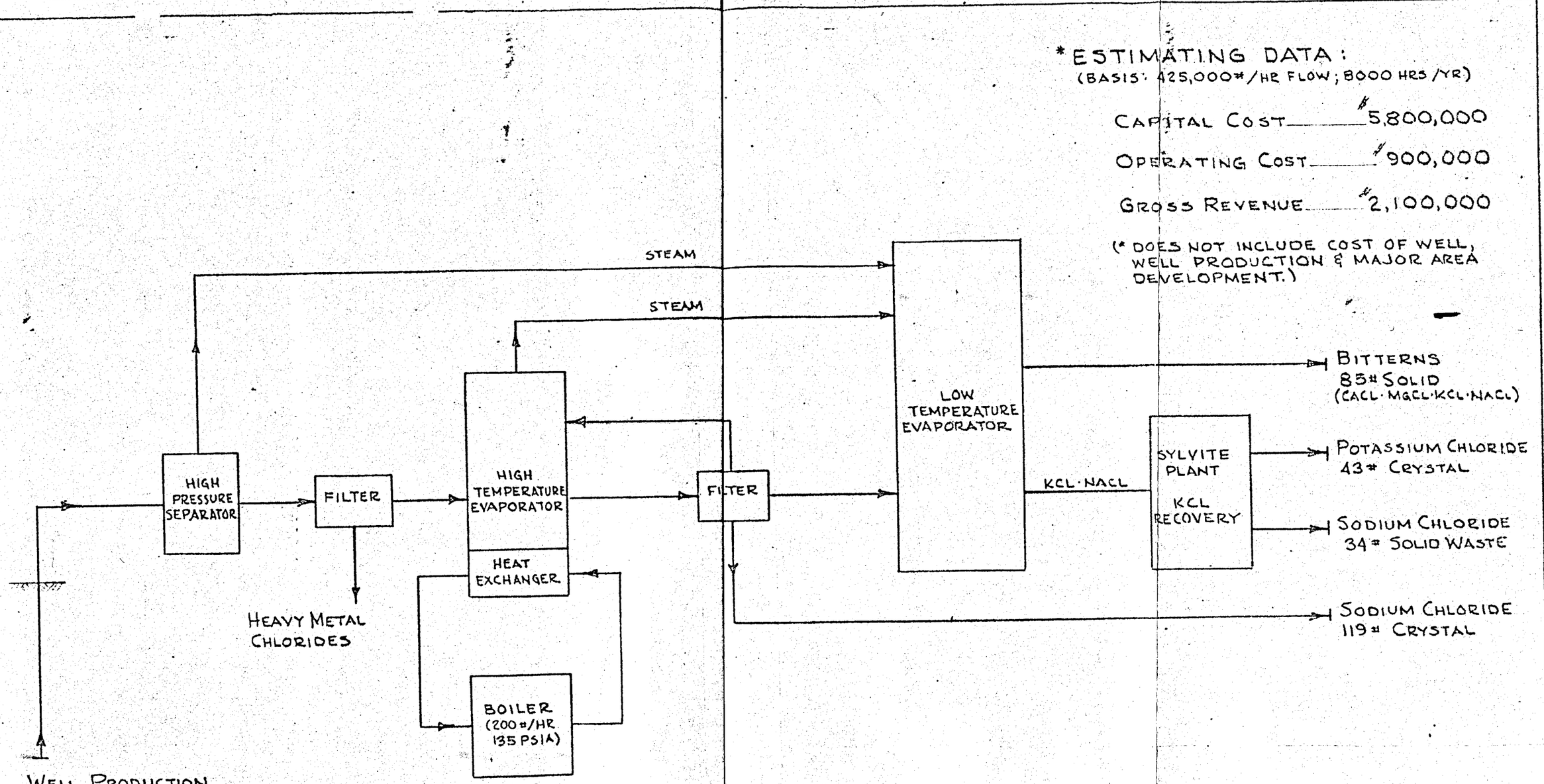
BITTERNS	144,000 TPY @ #0.50/TON
POTASSIUM CHLORIDE	73,000 TPY @ #25.00/TON
SODIUM CHLORIDE	126,000 TPY @ #1.00/TON
GROSS POWER	65 MILLION KWH/YR @ 5 MILS

NOTE: MATERIAL BALANCE BASED ON SAMPLE S-44 · JUNE 15, 1962

O'NEILL GEOTHERMAL, INC. - I.I.D. NO. 1

BLOCK DIAGRAM - SCHEME "A"
SOLAR EVAPORATION & POWER GENERATION

ROGERS ENGINEERING CO., INC.
APRIL 4, 1963 PG1-14 ONG-SK1-0



*ESTIMATING DATA:
(BASIS: 425,000#/HR FLOW; 8000 HRS/YR)

CAPITAL COST	$5,800,000
OPERATING COST	$900,000
GROSS REVENUE	$2,100,000

(* DOES NOT INCLUDE COST OF WELL, WELL PRODUCTION & MAJOR AREA DEVELOPMENT.)

REVENUE BREAKDOWN: (AT PLANT)

BITTERNS	144,000 TPY @	$0.50/TON
POTASSIUM CHLORIDE	73,000 TPY @	$25.00/TON
SODIUM CHLORIDE	203,000 TPY @	$1.00/TON

NOTE: MATERIAL BALANCE BASED ON SAMPLE S-44 · JUNE 15, 1962

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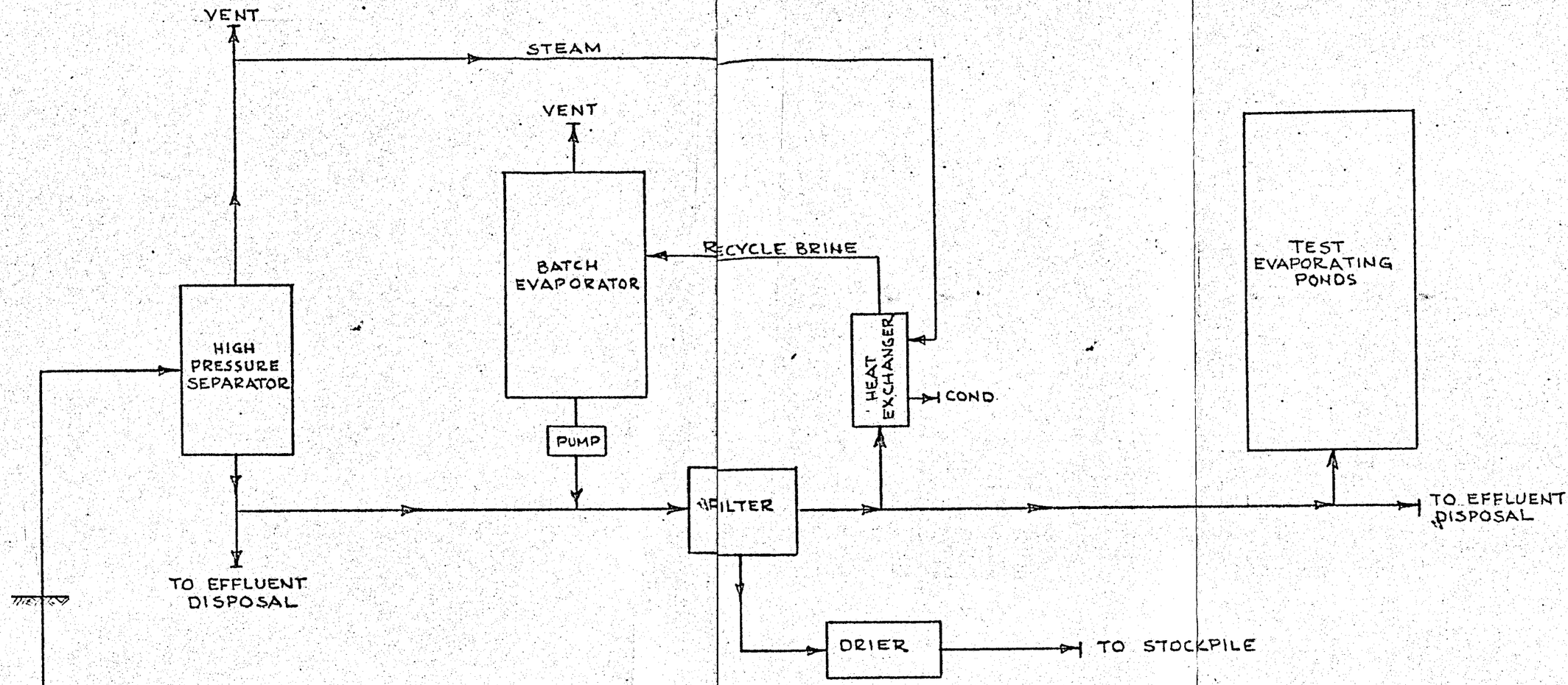
BLOCK DIAGRAM - SCHEME "B"
MULTI-STAGE EVAPORATION

ROGERS ENGINEERING CO., INC.
APRIL 4, 1963 PG1-14 ONG:SK2-0



OPERATING PROCEDURE:

1. OPEN WELL & ESTABLISH WELL FLOW.
2. ESTABLISH HIGH-PRESSURE SEPARATOR OPERATION AT SELECTED PRESSURE CONDITIONS. SEPARATOR BRINE PASSES THRU FILTER. FILTER CAKE IS DRIED & COLLECTED.
3. FILTRATE FLOWS TO BATCH EVAPORATOR OR TO TEST PONDS.
4. WITH BATCH EVAPORATOR CHARGED, EVAPORATOR BRINE IS RECYCLED BY THE PUMP THRU THE FILTER & HEAT-EXCHANGER. HEAT IS ADDED USING STEAM FROM THE SEPARATOR. SEPARATOR BRINE IS DISCHARGED TO THE DISPOSAL SYSTEM. FILTER CAKE IS DRIED & COLLECTED.
5. WITH EVAPORATING POND SYSTEM FILLED, POND LIQUOR IS PASSED THRU THE VARIOUS SYSTEM STAGES & AS EVAPORATION OCCURS, THE FRACTIONAL SALT SEPARATION OBSERVED.

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BLOCK DIAGRAM
PROVING - PLANT

ROGERS ENGINEERING CO., INC.
APRIL 4, 1963 P61-14 ONG-SK 3-0